BY ORDER OF THE LIEUTENANT GOVERNOR OF BENGAL * FORWARDED

PROGRESS REPORT

OF

THE FOREST SURVEY BRANCH

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FOR

1887-88.

BY

W. H. REYNOLDS, ESQ., F.R.G.S.,
SUPERINTENDENT OF FOREST SURVEYS

WITH THE REMARKS OF THE SURVEYOR GENERAL,

AND

THE ORDERS OF THE GOVERNMENT OF INDIA.

SIMLA:
PRINTED BY THE SUPERINTENDENT OF GOVERNMENT CENTRAL PRESS.
1889.

No. 516F., dated Simla, the 10th June 1889.

From—SIR E. C. BUCK, Secretary to the Government of India, Revenue and Agricultural Department,

To—The Surveyor General of India.

I AM directed to acknowledge the receipt of your letter No. 318-S., dated 23rd January last, submitting the Annual Progress Report of the Forest Survey Branch for the year 1887-88.

2. The principal field operations were confined to Berar, but other surveys in progress during the previous year in Bengal, the Punjab, and the North-Western Provinces were continued, and new surveys were taken in hand in the Central Provinces and in the North-Western Provinces.

3. In Berar, during the year, 760 square miles were topographically surveyed in detail, 207 square miles being mapped on the scale of 4 inches to 1 mile, and 553 square miles on the scale of 2 inches to a mile. The survey of the Melghat forests has now been completed, and a considerable area has been prepared in advance for detail survey in South Berar, as soon as it has been decided what lands shall be included in the "State Forests" under the new Forest Law, which is on the point of issue. The area already surveyed in detail in Berar includes the whole of the Melghat taluk, the Bingara jagir, the hilly portion of the Akola District adjoining the Melghat, and the State Forests of Garu-Matergaon in the Buldana District. In Bengal the boundary survey of the State Forests in the Singbhum District, and in the Punjab the survey of the leased forests in Bashahr, were continued. In the former Province 121 linear miles of boundary were surveyed, and in the latter 71·5 square miles of forest were mapped on the scale of 4 inches to 1 mile and the triangulation extended to 70 square miles. In the North-Western Provinces the topographical survey of the Ninglat and Gogar forests in the Naini Tal Division was completed, 31·8 square miles being topographically surveyed and mapped on the 4-inch scale. The survey of the Tehri-Garhwal forests in that Province was also taken in hand, and 190 square miles triangulated. In the Central Provinces, 116 square miles of State Forests in the Jubbulpore District were mapped on the scale of 4 inches to 1 mile, and 510 square miles were triangulated in the Raipur District.

4. In the office, besides the computing, the drawing of 113 sheets of maps was completed, tracings were made of 182 maps, 2,051 printed maps of various kinds were coloured, and lists were prepared of the best available forest-maps in the various Provinces.

5. During the recess three drawing classes were held by Officers of the Survey Branch for the instruction of the students of the Dehra Dun Forest School, and were attended by 57 students. Field instruction in surveying was also given to these students, under the superintendence of a Professor of the School, and Mr. Reynolds examined the students of the previous year, of whom 27 obtained certificates of qualification in surveying by the lower standard.

6. The amount of work done by the Forest Survey Branch during the year is satisfactory. The area topographically surveyed amounted to 979 square miles, of which 426 square miles were surveyed on the 4-inch scale and 553 on the 2-inch scale. This is materially in excess of the average* for the past three years, and the cost of the work done is also exceedingly moderate. The final rates for the survey of the Melghat forests are shown to amount to Rs. 80 per square mile for the surveys on the 4-inch scale, and to Rs. 57 per square mile for those on the 2-inch scale. These rates compare favourably with the final cost rates of other surveys, and are creditable to the Officers and Subordinates of the Forest Survey Branch.

*1884-85	...	203	square miles on 4-inch scale, and			208	square miles on 2-inch scale.		
1885-86	...	366	"	"	"	241	"	"	"
1886-87	...	508	"	"	"	395	"	"	"
Average	...	359	"	"	"	281	"	"	"

7. His Excellency the Governor General in Council notices that you are satisfied with the work done during the year by the Forest Survey Branch, and that you approve of the method and extent of the checks applied to the field surveys to ensure their accuracy, and concurs with you in considering that Mr. Reynolds continues to deserve the commendation that has been accorded to him in previous years for his management of the Forest Survey Branch.

No. 517F.

COPY forwarded to the Inspector General of Forests, for information and for communication to the Superintendent of Forest Surveys.

[G. N. K.]

G. C. Press, Simla.—No. 185 R. & A. D.—14-6-89.—280.

PROGRESS REPORT OF THE FOREST SURVEY BRANCH FOR 1887-88.

No. 318S., dated Calcutta, the 23rd January 1889.

From—COLONEL H. R. THUILLIER, R.E., *Surveyor General of India,*

To—*The Secretary to the Government of India,* REVENUE AND AGRICULTURAL DEPT.

I HAVE the honour to forward the Annual Progress Report of the Forest Survey Branch for the year 1887-88, submitted by Mr. W. H. Reynolds, Superintendent of Forest Surveys.

2. The operations were carried on in continuation of the previous season's work in Berar, in the Punjab (Bashahr), in Bengal, and in the North-Western Provinces; and the survey of the Melghat taluk and the Bingara jagir in Berar, with the hills in the Akola district adjoining, was completed. Surveys were initiated in the Reserved Forests of the Jubbulpore and Raipur Districts of the Central Provinces, and in Tehri-Garhwal of the North-Western Provinces.

3. The outturns of the field and office work are given in Appendices A and B. The area topographically surveyed amounts to 979 square miles, of which 426 square miles were surveyed on the 4-inch scale and 553 square miles on the 2-inch scale, against 508 square miles and 396 square miles on the respective scales during the previous year. The classes of areas surveyed are given in Appendix F. In addition to the above, 146 linear miles of forest boundaries were surveyed, of which 121 miles were traversed. Triangulation has been completed over 990 square miles, 510 square miles of which are in advance of the area surveyed in detail, and this area is ready for the current year's plane-table work. This summary of work is satisfactory; though much the same as last year, it is considerably in excess of the average outturn of topography for the last three years, which is 640 square miles. The larger outturn is attributed in part to portions of the country under survey being more open than is usually the case in forest tracts, and partly to improved efficiency in the establishment; but the traverse basis provided by this Department in the Jubbulpore District was also of material assistance to the progress and cost of the work there, as it required the addition of a few triangulated points only in the interior of the forests to furnish the complete frame-work for the detail survey.

4. The nature of the tests that have been applied to the field survey to insure its accuracy is explained in paragraph 35 of the Report. The method and extent of these checks are quite satisfactory, and, where European agency has been employed thereon, nothing further can be desired. It is necessary, however, that the status of the supervising assistants should be such as to guarantee integrity in the very important duty of examining the field-work.

5. The cost of the work in Berar is R64 per square mile for the 4-inch and R42 for the 2-inch survey; these rates are slightly lower than in the previous year, when they were R67 and R46, respectively. The rate in Bashahr has increased from R47 to R60, which is accounted for by the short duration of the field season; the present rate, however, is very low. In Jubbulpore, the cost of the 4-inch work is R50, which is exclusive of the traverse operations. The final cost rates of the Berar Survey which has been completed, as obtained from the total expenditure incurred thereon, are R80 for the 4-inch survey and R57 for the 2-inch work.

6. During the recess, drawing classes were held for the instruction of the Forest School students, 57 in number, who had gone through the practical course in surveying during the previous cold weather. These students were finally examined by Mr. Reynolds, and 27 passed and obtained certificates of qualification in surveying according to the elementary standard.

7. The return of mapping in Appendix B shows good progress. The drawing is effective, and the class of work, as far as can be judged from the maps, is satisfactory. A catalogue of the published maps of all classes of forests and waste lands is in course of preparation. A Forest Map of India on the 48-mile scale is under compilation, to illustrate the forest areas under the Government throughout India, as well as other forest details. This should be a very useful map of reference.

8. I consider that Mr. Reynolds, from the results of this year's operations, continues to deserve the commendation that has been accorded to him in the two previous years for the management of the Forest Survey Branch.

9. The Expenditure during the year amounted to R75,698 (of which R40,656 is chargeable against the Berar Revenues), against R75,423 in 1886-87 and R68,358 in 1885-86.

CONTENTS.

The Season's Field Work.

	PARA.
Surveys completed or in progress	2
New surveys commenced during the year	3
Duration of the field season	4
Topographical area surveyed	5
Comparison with previous year	6
Triangulation and boundary surveys	7
Berar.	
Division of establishment	8
Area topographically surveyed	9
Season's cost rate	10
Total area surveyed to date	11
Survey in South Berar postponed	12
Final cost rates	13
Western boundary of Melghat pending settlement	14
Bengal.	
Singbhum boundary surveys	15
Cost	16
Punjab.	
Bashahr 4" survey	17
Topographical and triangulated areas	18
Cost	19
NORTH-WESTERN PROVINCES.	
Central Circle.	
Ninglat and Gogar forests	20
Area surveyed	21
Chandi and Ganges forest boundary survey	22
School Circle.	
Tehri-Garhwal forests	23
Area triangulated and cost	24
Total Expenditure, North-Western Provinces	25
Central Provinces.	
Orders to take up Forest Surveys in Central Provinces	26
Jubbulpore survey	27
Area topographically surveyed and triangulated	28
Tests applied to work	29
Cost	30
16" boundary survey	31
Raipur survey	32
Area triangulated, and cost	33
Total expenditure in the Central Provinces	34
Tests applied to field sections and supervision	35
Summary of season's field work	36
Office Work.	
Computations	37
Areas deduced	38
Map drawing	39

PARA.

Map drawing, North-Western Provinces and Oudh 40
Ditto, Punjab 41
Ditto, Bengal 42
Ditto, Berar 43
Ditto, Central Provinces 44
Tracings and other miscellaneous work 45
Lists of best available Maps for Forest purposes 46
Forest Map of India 47

Instruction of Forest School Students.

Drawing classes 48
Field instruction in Surveying 49

Expenditure for the year.

Imperial Forest Surveys 50
Berar ditto 51
Total expenditure of Forest Surveys 52

Officers of the Superior Staff.

Mr. W. H. Reynolds, Superintendent of Forest Surveys 53
Mr. E. F. Litchfield, Officiating Deputy Conservator of Forests 54

Forest Surveyors.

Mr. G. P. Chill 55
Mr. T. S. Marten 56
Mr. J. Marten 57
Mr. A. Descubes 58

Sub-Surveyors.

Strength of Native Establishment 59
Health of Establishment 60
Work done by the Survey of India for Forest Surveys 61
Documents accompanying the Report 62

BENGAL SECRETARIAT LIBRARY

ANNUAL PROGRESS REPORT

OF THE

FOREST SURVEY BRANCH OF THE FOREST DEPARTMENT,

FROM 1ST OCTOBER 1887 TO 30TH SEPTEMBER 1888.

BY

W. H. REYNOLDS, ESQ., F.R.G.S.,

SUPERINTENDENT OF FOREST SURVEYS.

During 1887-88, the operations of the Forest Survey Branch were, with the exception of three months whilst he was on privilege leave, under the charge of Mr. W. H. Reynolds, Superintendent of Forest Surveys: during Mr. Reynolds' absence, Mr. E. Litchfield, Officiating Deputy Conservator of Forests, officiated in charge. The operations that are now reported are for the year ending 30th September 1888.

THE SEASON'S FIELD-WORK.

Surveys completed or in progress.

2. The main field operations, as was the case the previous year, were confined chiefly to Berar; and the survey of the Melghat Taluk, together with the Bingara jagir and the hills in the Akola District adjoining the Melghat taluk, were completed. The two latter surveys were done in accordance with the Resident's wishes, which were conveyed to the Superintendent in Berar Commissioner's letters Nos. 837 and 1781, dated, respectively, the 23rd February 1885 and 21st April 1885. Other surveys in Bengal, the Punjab, and the North-Western Provinces, which were in progress in the previous year, were continued during the year under report, and other new surveys were commenced.

New surveys commenced during the year.

3. The new surveys taken in hand during the year were :—(*a*) the Reserved Forests in the Jubbulpore District, as well as (*b*) the Reserved Forests in the Raipur District, of the Central Provinces, and (*c*) the Reserved (Leased) Forests of Tehri-Garhwal in the School Circle of the North-Western Provinces.

Duration of field season.

4. The average duration of the field season for the parties working in Berar and the Central Provinces was about 7½ months; but owing to the inaccessible portions, at certain seasons of the year, of the forests in the Himalayas—that is to say, in Bashahr and Tehri-Garhwal—it was not possible to obtain more than three months of a field season.

The Berar party took the field in the middle of November, and the last of the surveyors did not return to recess quarters until the 15th July.

In the Central Provinces, field-work was carried on from the 25th November 1887 to the 25th April 1888, and other parties, who worked in the North-

Western Provinces, were out for various periods, averaging from one to four months.

Topographical area surveyed.

5. The total area topographically surveyed in detail, and for which the usual Forest information has been compiled, amounts to 979 square miles, of which 426 square miles have been surveyed on the 4″ scale, and 553 on the 2″ scale. The classes of areas surveyed are given in Appendix F, and the details of the areas topographically surveyed are given in Appendix A.

Comparison with previous year.

6. The aggregate area topographically surveyed during the previous year (1886-87) was 903 square miles, against an outturn of 979 square miles during the year under report: the average for the last three years is 640 square miles.

The favourable result of the present season's outturn is due, in part, to portions of the country under survey having been more open than is usually the case in Forest Survey work, and it is also due to improved efficiency in the establishment, as well as to the fact that the Berar party was kept in the field later than usual so as to complete the Melghat survey.

Triangulation and boundary surveys.

7. In addition to the above, triangulation was extended over an area of 990 square miles, as against 510 square miles in the previous field season, and 146 linear miles of forest boundaries were also surveyed.

Berar.

8. The Melghat survey party, with head-quarters at Chikalda, took the field on the 15th November 1887, and the last of the surveyors returned to recess quarters on the 15th July 1888.

Division of establishment.

The party was composed of Mr. E. Litchfield, Officiating Deputy Conservator of Forests, two European assistants, and a staff of Native surveyors; and, for Topographical Survey purpose, it was divided into four sections, three of which worked under European supervision, and the fourth party worked under the supervision of a skilled Native surveyor of proved ability; later in the season a second Native surveyor was added to the staff of supervisors. The entire work was supervised by Mr. Reynolds, the Superintendent, who was with the Berar party from the end of January to the 4th April, except for a short interval in February, when he visited the Raipur triangulating party.

Section No. 1, under Mr. Litchfield, worked on the 2″ scale and completed areas in the Dulghat Pergunnah, chiefly in sheets Nos. 13 and 14; the 2nd Section, under Mr. Chill, worked partly on the 4″ and partly on the 2″ scale, and was employed in completing portions of sheets Nos. 20 and 20A; Mr. James Marten, with Section No. 3, was engaged on 4″ work in the Amner Pergunnah and the Bingara jagir; and the 4th Section was employed in completing the survey of the Bairagarh Reserve on the 2″ scale.

Area topographically surveyed.

9. The area topographically surveyed was 760 square miles, of which 207 square miles have been surveyed on the 4″ scale and 553 square miles on the 2″ scale. The average number of plane-table stations per square mile is 102, and 21 additional stations per square mile were added by the supervising assistants in testing and checking the work.

10. The cost of the season's work, estimated on the area plane-tabled, is for the 4″ survey R64 per square mile, and R42 per square mile for the 2″ work. In the previous year the cost rates were R67 and 46, respectively.

Season's cost rate.

11. Up to date, the survey operations in Berar have extended over an area of 2,799 square miles; 2,505 square miles have been triangulated; the traversing has extended over 2,443 square miles; and a detailed Topographical Survey of 2,150 square miles has been completed, of which 931 square miles have been surveyed on the 4″ scale and 1,219 square miles on the 2″ scale.

Total areas surveyed to date.

The detail survey comprises the *entire* Melghat taluk, the Bingara jagir, the hilly portion of the Akola District adjoining the Melghat, as well as the State Forests of Garu-Matergaon in the Buldana District. As may be seen from the foregoing figures, a considerable area has been prepared in advance in South Berar for detail survey.

12. A new Forest Law for Berar is on the point of issue, in which only one class of forests, called "State Forests," is recognised, and it is now under consideration what of the Forest Department lands shall be brought under the new Law as "State Forests;" and as it is very possible that, under the new Law, additions may be made to the old demarcated Reserves, which alone were originally intended to be surveyed, the Resident at Hyderabad considers it advisable that, for the present, the survey of the South Berar Reserves should be postponed, so as to avoid going over the ground a second time.

Survey in South Berar postponed.

13. Under the circumstances noted in the previous paragraph, and as the survey of the entire Melghat taluk and other areas has been completed, it is desirable that the final cost rate of the completed areas should be recorded.

Final cost rates.

The total expenditure incurred by the Forest Survey Branch on account of Surveys and other work done for the Berar Government, since the Survey Branch entered the Province in 1883 and up to 1st October 1888, is R1,95,968; the amount expended under Survey heads, and from which the final cost rates of the survey are deduced, is R1,62,989. A detailed statement showing the expenditure under Survey headings is given in Appendix E. From these figures it will be seen that the cost per square mile of areas completely surveyed is for the 4″ scale R80, and R57 for the 2″ work. These figures are somewhat higher than the annual cost rates for the past two years, but this is due to the fact that much heavier charges for triangulation and traversing were incurred in the earlier years of the survey *for work in advance* than was incurred under these heads during the last two years of the survey. The figures, therefore, noted above might be accepted as the figures of final cost per square mile for the completed Berar areas.

In previous Forest Survey Progress Reports the following final cost rates are given for 4″ surveys already completed by the Forest Survey Branch:—

		R
Kumaun and Garhwal		115
Himalayas	Jaunsar and Tons	192
	Bhagirathi	127

The final cost rates for the survey of the Melghat taluk *viz.*, R80 per square mile for surveys on the 4″ scale and R57 per square mile for those on the 2″ scale compare favourably with the final cost rates of previous surveys.

The *estimated cost* of the Melghat Survey, which was based upon the figures for the Kumaun and Garhwal Surveys, was for the 4″ survey estimated at R140 per square mile, and R70 per square mile was estimated for the 2″ work. Thus it will be seen that the final cost of the Melghat Survey is well within the estimated figures.

Western boundary of the Melghat pending settlement.

14. It is necessary to note here that the western boundary of the Melghat taluk touching on Nimar is still unsettled; the boundary is a very important one, as it forms the Provincial boundary between Berar and the Central Provinces. The boundary shown on the maps of the Hyderabad Topographical Survey, 1860-61, and that shown by the Revenue Survey maps of 1869-70, do not in all respects accord, and a third line of boundary exists on the ground, the latter being demarcated by 36 masonry pillars. The pillars were built in 1877, and the line demarcated by these pillars is acknowledged by the Deputy Commissioner of Nimar as the correct Provincial boundary. The Commissioner of Berar, however, declines to accept the line demarcated by masonry pillars, unless it can be shown that the pillars have been built upon the original line decided upon by competent authority. It is clear that either one or other of these lines must be accepted, unless an entirely new line of boundary is adopted.

The case is still under consideration, but, until a decision is arrived at, it will not be possible to pass through the press the new map sheets containing the western boundary of the Melghat.

Bengal.

Singbhum boundary surveys.

15. The boundary survey of the State Forests in the Singbhum District, which was left unfinished the previous year owing to the demarcation being incomplete, was continued during the year under report, but, owing to the demarcation of the southern boundary of the Saranda Forest being still under consideration, the entire work could not be completed.

Cost.

16. In all, 121 linear miles of boundary were dealt with, at a cost of R377. The traversing was proved during the recess season.

The total expenditure incurred, on account of Bengal, for field and office work, as well as for other work of a special nature, was R1,317.

Punjab.

Bashahr 4″ survey

17. In the Punjab, the only survey that is in progress is the survey of the leased forests of Bashahr. The tracts under survey during 1887-88 were for the most part situated at high elevations, and hence were inaccessible, except at certain seasons of the year; the consequence is that it was only possible to have parties in the field for a very short period of three months, and some of this time was spent in marching. The procedure adopted in the Bashahr Survey was detailed in paragraph 6 of last year's Report, but it appears necessary to state here that the leveled contour lines are added to the field sections after the *completion* of the topographical work and not by the surveyor who surveyed the topographical details, but by a different assistant and one of proved ability, and hence it is that all the leveled contour lines became test and check lines as well.

18. The area topographically surveyed was 71·5 square miles, and the triangulation was extended by 70 square miles. The triangulation is well in advance of the detail survey, as might be seen from the index map of Bashahr annexed. The total area topographically surveyed to date is 360 square miles.

Topographical and triangulated areas.

19. The cost of the season's field-work, comprising triangulation, computation, and detail surveys, was R2,422, and the total expenditure, including all charges, for Bashahr is R4,284. The field season was such a short one that the cost rates cannot well be compared with rates of the previous year; they are R60 per square mile, if estimated on the area plane-tabled.

Cost.

Now that the whole of Bashahr has been allotted to the Forest Survey Branch for survey, it will be possible to arrange a more satisfactory field season, and one of at least six or seven months' duration.

North-Western Provinces.

20. The detail survey of the Ninglat and Gogar forests in the Naini Tal Division, the triangulation of which was done in the previous year, was completed during the field season of 1887-88.

Central Circle.

Ninglat and Gogar forests.

The Topographical Survey here was done in the same way as that in Bashahr, that is to say, the detail survey was done by one set of surveyors, and the entire area was subsequently gone over by a different and more skilled surveyor, who tested and checked the work by measuring contour lines at vertical distances of 500 feet. The work of this detachment was scrutinised in the field by Mr. Reynolds between the 1st and 7th January.

21. The area surveyed in detail on the 4" scale amounts to 31·8 square miles.

Area surveyed.

It is necessary to note here that although the outer boundaries of the Ninglat and Gogar Forests are limited, for the most part, by natural features, yet the demarcation of the interior chaks or village lands was not completed at time of survey. A surveyor will have to be deputed later on to add the boundaries, as soon as it is reported that they are ready for survey.

22. In the Chandi and Ganges forests, 25 miles of revised forest boundaries were measured by plane-table.

Chandi and Ganges forest boundary survey.

23. The survey of the Tehri-Garhwal forests in the School Circle of the North-Western Provinces, which was ordered during the year, was taken in hand, and the triangulation was completed before the rains. The forests are situated at high altitudes and are difficult to get at, and are only accessible for survey purposes for short periods just before and immediately after the rains.

School Circle.

Tehri-Garhwal forests.

24. The area triangulated in Tehri-Garhwal was 190 square miles, at a cost of R430.

Area triangulated and cost.

25. The total expenditure incurred by the Forest Survey Branch on account of work done for the North-Western Provinces and Oudh Government, and including R500 for drawing Kumaun and Garhwal maps and R217 for Kheri maps, was R2,147.

Total expenditure, North-Western Provinces.

CENTRAL PROVINCES.

Orders to take up Forest Surveys in Central Provinces.

26. In October 1887 the Superintendent of Forest Surveys received official intimation that the survey of the Reserved Forests in the Central Provinces were to be taken in hand, and that the Districts of Jubbulpore and Raipur had been allotted to the Forest Survey Branch for the purpose of completing the detail survey of the forests on the 4" scale, the traversing of the boundaries having already been done by the Revenue Survey Department.

Jubbulpore Survey.

27. Early in November a party for Jubbulpore was organized, which commenced field operations before the close of the month, and returned again to recess quarters at Dehra by the end of April.

The season's field-work was confined entirely to the Bargi Pergunnah, and the work of the party was supervised and checked by Mr. T. Marten.

After commencing the detail survey, it was found that the boundary traverse stations *alone* were insufficient as a basis for the detail survey as carried out for Forest purposes, and hence it became necessary to fix additional points by triangulation in the interior of the forests.

Area topographically surveyed and triangulated.

28. The area topographically surveyed in full detail was 116 square miles, comprising 36 Reserved Forests, and triangulation was extended over an area of 220 square miles. The Jubbulpore index map attached hereto illustrates the areas surveyed in detail.

Tests applied to work.

29. The topography was done in the same detail as the Berar work, and it was tested and checked by Mr. T. S. Marten, who, after the topography was finished, ran leveled contours throughout the work at vertical distances of 250 feet. Mr. Reynolds was with this party from 10th to 15th January, and examined the field sections of most of the surveyors.

Cost.

30. The cost of the field and office work of the season was R5,421, and the total expenditure on account of the Jubbulpore Survey was R5,902. The cost rate per square mile, estimated on the area plane-tabled, is R50; the cost rate for similar work done in Berar during the year under report, and on a like scale, was R64 per square mile. The traverse data received from the Surveyor General's Department proved most useful.

16" boundary survey.

31. On the completion of the season's work, tracings of all the outer boundaries of the forests surveyed were sent to the Conservator of Forests, so that they might be attested by competent authority before they were finally adopted and drawn on the fair maps for publication. This led to a proposal from the Local Government to the Government of India that the outer boundaries of forests should be surveyed on the 16" scale; the proposal was sanctioned in Government of India (Revenue and Agricultural Department) letter No. 417 F., dated 8th November 1888.

Raipur Survey.

32. Early in January a triangulating party was deputed to the Raipur District to commence the triangulation of the Reserved Forests in the south-eastern part of the district.

33. Triangulation was extended over an area of 510 square miles in the forest tracts of the Sahawa and Dhamtari Tahsils at a total cost of R888. The area triangulated in advance of detail survey is shown on the index map of the Raipur District attached to this Report. The field-work was closed about the middle of April.

Area triangulated, and cost.

34. The total expenditure incurred on account of the Central Provinces during 1887-88 on field and office work was R6,790; *viz.*, in the Jubbulpore District R5,902, and in Raipur R888.

Total expenditure in the Central Provinces.

35. All surveys that have hitherto been undertaken by the Forest Survey Branch have, as a rule, been in mountainous or very broken country, where, ordinarily, it is not possible to run chain test lines across country, such as might be done in open and flat tracts; but, to ensure a safe check on the work of the detail surveyors, level contour lines are run throughout the work at prescribed vertical distances. The level contours are run after the topography is finished, and not by the detail surveyor himself, but by a skilled supervising assistant, who at the same time examines and tests, *in situ*, the whole of the work done by the detail surveyor. Thus it is that all the leveled contour lines which are run by supervising assistants throughout the length and breadth of the tracts under survey become so many check and test lines to the work, and a more stringent check than this can scarcely be adopted. In flat country the precaution is taken of running check lines with the chain; this was done in the black-soil villages of Bairagarh. The supervising assistants do no original plane-table work themselves (except perhaps very early in the season before any detail work is ready for examination); they are simply expected to run the leveled contour lines, examine thoroughly the detail work of the sub-surveyors, and finally to ink in (after making all necessary corrections and additions) the field sections. The Superintendent himself makes it his business to visit, in turn, each of the field camps, and on these occasions he closely scrutinizes the quality of the work, and examines, *in situ*, portions of it. All detail Topographical Surveys done during the year under report have been tested and checked by having level contour lines run through them by skilled assistants of proved ability.

Tests applied to field sections, and supervision.

Only one central computing office was maintained for all field parties, as well as a single central office for accounts; these branches were personally controlled and supervised by the Superintendent himself.

36. In Appendix A will be found a summary of the outturn of the season's field-work.

Summary of season's field-work.

Office Work.

37. An abstract of the outturn of computations will be found in Appendix A. The rectangular co-ordinates of 4,373 traverse stations were computed in duplicate. The number of triangles computed in duplicate was 796, and the rectangular co-ordinates of 672 trigonometrical stations were deduced. To determine the heights above sea level of 629 stations, 1,258 triangles were worked in duplicate. The latitudinal and longitudinal values of 107 stations of the Great Trigonometrical Survey were converted into rectangular co-ordinates;

Computations.

and 4,065 heights above sea-level were deduced from observations taken with the tangent scale clinometer.

Areas deduced.

38. The areas of 2,814 fields and of 123 villages in the Melghat have been deduced in duplicate. The Conservator of the Central Circle, North-Western Provinces and Oudh, has been supplied with detailed area statements of various forests in the Kumaun, Naini Tal, and Garhwal Divisions; the Conservator of the Punjab has been furnished with detailed area statements of the Reserved Forests in the ilâkas of Kotkhai and Kotgarh in the Simla District, and also of the Kalesar Forest in the Umballa District. In Oudh, the Working-Plans Officer of the Kheri Forests was supplied with very detailed statements of the areas of the blocks and compartments of the forests in the Kheri Working-Circle.

Map drawing.

39. Appendix B gives a summary of the original drawings under preparation during the year, as well as other miscellaneous office work.

North-Western Provinces and Oudh.

40. Six standard sheets of the Kumaun and Garhwal forests, on the scale of 4″ = 1 mile, have been sent to the press. This completes the series of 81 Kumaun and Garhwal sheets on the 4″ scale for the forests of the Central Circle of the North-Western Provinces. The printing of some of the last sheets was delayed owing to certain boundary questions being undecided, the last of which was only finally settled at the close of the present Survey year.

Fifteen sheets of the Kumaun and Garhwal forests have been reproduced on the 2″ scale from the original drawings or from prints on the 4″ scale; some of the results are not altogether satisfactory, as the original drawings were prepared for reproduction to the same scale and not for reduction to ½ scale.

Four charts of triangulation and traversing on the scale of 1″=1 mile of the Kumaun and Garhwal Survey have been completed and sent to press, and an index chart to the field sheets of the Kumaun and Garhwal Survey is in progress.

A map of the Saharanpur Forest Division, on the scale of 1″=4 miles, is in progress.

Six standard sheets, on the 4″ scale, of the forests of the Kheri Working Circle in Oudh have been sent to press; these sheets are intended for the Kheri Forest Working-Plan, which is at present under consideration.

Punjab.

41. For the Punjab, a map of the forests in the Kotkhai Ilaka, on the scale of 4″=1 mile, in two sheets, has been published; these sheets have the hill shading in brown and are in skeleton form as well: Punjab standard sheet No. $332^{\frac{S.W.}{3}}$, containing Government forests in the district of Simla on the scale of 4″=1 mile, is in the press. Seven maps of the Chamba forests on the scale of 2″=1 mile are in progress, two are in the press, and the other sheets are well advanced and should be in the press by the close of the year. A map of the Kangra District in two sheets, showing the Reserved and Protected Forests of the district, on the scale of 2 miles =1 inch, was prepared and passed through the press, and a map for forest purposes of the Pangi Valley, in Chamba territory, on the scale of 1″=1 mile, has been published.

Bengal.

42. Of the Bengal standard maps, nine sheets of the Government forests in the Singbhum District, on the scale of 4″=1 mile, have been published (these are boundary maps), and 15 similar sheets on the same scale have been sent

to press. A map of the Bamanpokri Forest in the Darjeeling Division on the scale of 8″=1 mile is in the press.

Berar.

43. Nineteen standard sheets of the Berar Survey on the 4″ scale and 10 sheets on the 2″ scale are in progress; four of these sheets are in the press, and the others are well advanced: Sheet No. 26 $\frac{N.W.}{1}$ on the 4″ scale was published during the year. A map of the Bingara Jagir on the scale of 4″=1 mile is in progress, and three maps, on a similar scale, of black soil villages in the Bairagarh Reserve, as well as a map of the Daryapur Taluk for forest purposes; on the scale of 1″=1 mile, are also in progress. Six charts of triangulation and traversing have been drawn on the scale of 1″=1 mile, but the printing is yet to be finished.

Central Provinces.

44. An index map to the Forest Survey of the Jubbulpore District was drawn on the scale of 4 miles to the inch for reproduction to half scale; this has passed through the press, and so also has a similar index map to the Forest Survey of the Raipur District.

Tracings and other miscellaneous work.

45. For the Forest Department and various District Officers, 182 tracings were made, 839 printed maps were cut up and mounted in book form, and 2,051 printed maps were coloured.

Lists of best available printed Maps for Forest purposes.

46. Detailed lists of the best available printed maps of Reserved, Protected, and Unclassed Forests and Waste Lands in the several provinces under the Government of India are in course of preparation. The following lists are in the press, *viz.*:—

Bengal.
Assam.
North-Western Provinces and Oudh { Central Circle. / Oudh „ / School „ }
Punjab.
Central Provinces.
Berar.
Ajmere and Merwara.
Coorg.

The Burma lists are in hand.

There is a complete set of all maps noted in the detailed lists referred to above in the office of the Superintendent of Forest Surveys, arranged provincially, and the Forest information on these maps, which is fairly well posted up to 1st April 1887 (but which is constantly undergoing changes, as new tracts are transferred to Reserved or Protected Forest areas), is expected to be kept posted (as far as possible) to date. During the year under report, Forest information was added to 614 printed maps; this branch of the work is by no means light, for it requires constant attention, and must be permanently kept in the hands of a skilled assistant; Mr. Descubes is engaged on this particular branch of the work, and he handles it in a most able manner.

Forest Map of India.

47. A Forest map of India is under compilation, and is expected to be ready early in 1889. The map is on the scale of 48 miles to the inch, and it will illustrate, in colours, the Reserved and Protected forest areas in the several Provinces immediately under the Government of India, as well as similar forest

tracts in the Madras and Bombay Presidencies; it will also illustrate the limit of Conservators' and Divisional Officers' charges, and will contain a forest area statement corrected to 1st April 1888, together with other forest details. This map will be a most useful one, as a map of reference, as well as an index map for forest purposes.

Instruction of Forest School Students.

Drawing classes.

48. Three drawing classes, composed of 57 Forest School students, were held in the Forest Survey Office, from the 3rd July to 31st October; the classes were instructed by Messrs. T. S. Marten, James Marten, and A. Descubes, assistants in the Forest Survey Branch, and the hours of attendance were from 7 to 8½ A.M.

Field instruction in Surveying.

49. The field instruction in surveying to the above students was carried out by Dr. Warth during the cold weather, and during November and the early part of December. Mr. Reynolds examined finally the students of the previous year, of whom 27 passed and received certificates of qualification in surveying by the lower standard, as laid down in paragraph 52 of the third edition of the Forest Department Code.

Expenditure for the year.

Imperial Forest Surveys.

50. Appendix C exhibits the expenditure for the year on field and office work in the School, Central, and Oudh Circles of the North-Western Provinces, Bashahr in the Punjab, Singbhum in Bengal, and Jubbulpore and Raipur in the Central Provinces, as well as charges for work not connected with these Surveys.

In the North-Western Provinces and Oudh an expenditure of R2,147 was incurred, of which R1,500 was on account of surveys done in the Central Circle; R430 was expended on field-work in the School Circle, chiefly on triangulation; and the expenditure in the Oudh Circle was R217, for the most part on account of preparing the fair sheets of the Kheri Survey for publication.

In the Punjab, the cost of the field and office work in Bashahr was R4,284; in Singbhum (Bengal) it was R1,317; and the expenditure on field and office work in the Raipur and Jubbulpore Districts of the Central Provinces was R3,790. A sum of R3,577 was paid to the Survey of India Department for photozincographing original fair sheets and supplying printed maps to the Forest Survey Branch. The total cost of field and office work in Imperial Forest Surveys, including all expenditure, was R35,042.

Berar Surveys.

51. The expenditure on field and office work of the surveys in Berar, as well as other charges of miscellaneous expenditure, will be found in Appendix D. The sum of R36,433 was expended on field and office work, and, including all charges, the total expenditure was R40,656.

Total expenditure of Forest Surveys.

52. The total expenditure for the year incurred by the Imperial Forest Survey Branch, including the expenditure for Berar, amounts to R75,698 against R75,423 in 1886-87 and R68,358 in 1885-86.

Hitherto the total expenditure incurred by the Forest Survey Branch (excluding the expenditure for Berar, which is local) has been an Imperial charge;

but the Government have now decided that the charges which have hitherto been Imperial will in future, with certain exceptions, be partly Provincial and partly Imperial, and the division of the charges will be governed by the orders laid down in Government of India (Revenue and Agricultural Department) Circular No. 16F., dated 2nd July 1888.

Officers of the Superior Staff.

Mr. W. H. Reynolds, Superintendent of Forest Surveys.

53. With the exception of three months, whilst he was on privilege leave, Mr. W. H. Reynolds, Superintendent of Forest Surveys, held charge of the Forest Survey Branch throughout the year. During the first month of the survey year, Mr. Reynolds was with the Bashahr party; in November and during the early part of December he was in camp with the Forest School students, holding final examinations in surveying; in January he examined the field work of the Ninglat-Gogar Survey, as well as the work in the Jubbulpore District; from the end of January to the beginning of April, Mr. Reynolds personally supervised the field-work in the Melghat. From the 5th April to 4th July he was on privilege leave. After resuming charge of his office, on return from privilege leave, Mr. Reynolds received orders by telegram to meet at Poona the Secretary to the Government of India in the Revenue and Agricultural Department, in connection with the Bombay Forest Surveys; he was at Poona from the 18th to 20th July, and returned to Dehra on 29th, having taking Nagpur *en route* to confer with the Conservator of Forests regarding the Forest Surveys that are in progress in the Raipur and Jubbulpore Districts.

Mr E F Litchfield, Officiating Deputy Conservator of Forests.

54. Mr. Litchfield, Officiating Deputy Conservator of Forests, took the field on the 27th November 1887, and returned to recess quarters on the 24th June 1888; he was employed throughout the field season in the Melghat. From the 5th April to 4th July, he officiated for Mr. Reynolds, during the latter officer's absence on privilege leave. During the recess season, Mr. Litchfield has been employed chiefly upon the fair drawing of the 2" Melghat maps, and in supervising and passing the detailed area statements of the Melghat Taluk. He has done well both in the office and in the field, and has turned out a very creditable season's work.

Forest Surveyors.

Mr. G. P. Chill.

55. Mr. Chill took the field on the 16th January; up to this date he was employed upon bringing up the fair drawing of the 4" Melghat sheets, which were falling into arrears. He was employed throughout the field season upon supervising and testing the detail work of a section of the Melghat Survey; he returned to recess quarters at Chikalda on the 23rd July, and on the 24th August he was called up to the head-quarters office at Dehra, where he continued to prepare the fair drawings of the Melghat sheets up to a short period of the close of the survey year, when he fell seriously ill. The Superintendent regrets to record that, after a short illness, Mr. Chill died on the 6th October, of pneumonia. He had always been a steady reliable worker, and the Forest Survey Branch has lost in him an excellent draughtsman and field surveyor, and a very good assistant.

Mr. T. S. Marten.

56. Mr. T. S. Marten, who had been employed the previous season on surveys in Bengal, was during the year under report employed on the detail survey of the Reserved Forests in the Jubbulpore District. He left Dehra on the 17th November, and by the close of the month he had commenced field operations in the Burgi Pergunnah. He completed the survey of the Reserved Forests in the Burgi Pergunah before his return to recess quarters, where he arrived on the 5th May. Mr. T. Marten has worked zealously and well throughout the year, and showed much tact in handling his sub-surveyors. He was employed during the recess months chiefly on the fair drawing of the 2″ Melghát maps, and in bringing up the Singbhum drawing.

Mr. James Marten.

57. Mr. James Marten left Dehra for Berar on the 18th November, and commenced field operations in the Melghat on the 26th; he was employed, throughout the field season, on 4″ detail surveys in the Amner Pergunnah of the Melghat Taluk and the Bingera Jagir in the Akola District. He was in the field from the end of November to the middle of July, and returned to Dehra on the 29th July. He was employed during the recess months chiefly in drawing the 4″ fair sheets of the Melghat. Mr. James Marten has as usual worked well, both in the field and in office.

Mr. A. Descubes.

58. Mr. Descubes has been employed, throughout the year, at the head-quarters office at Dehra, in preparing special forest maps for the press; but he has chiefly been engaged on posting up Forest information on sets of provincial maps on various scales, which is a very laborious task, and he has also done much work of a miscellaneous character, including the preparation of numerous detailed area statements. Mr. Descubes is a very willing, hard-working, and steady assistant, and works in a most zealous and thorough manner; he certainly deserves advancement.

Sub-Surveyors.

Strength of Native establishment.

59. The average strength of the Native Establishment employed during the field season on each kind of work was:—

Triangulation	2
Traversing	1
Plotting, &c.	1
Computing	2
Plane-tabling	22
In the field	28
At head-quarters	14
Total	42

With very few exceptions, all the field surveyors worked willingly and well, although at times under considerable difficulties. Salig Ram, Bhup Singh, and Oodey Singh deserve mention as having done good field work; and Kali Kanth Kar, Badri Dutt, and E. MacMaster, as well as Tulsi Ram, are good office hands.

Health of the Establishment.

60. On the whole the health of the establishment throughout the year was fairly good; but immediately after the close of the survey year, the Superinten-

dent regrets to record the death of Mr. G. P. Chill, whose loss is much felt in the Forest Survey Branch.

WORK DONE BY THE SURVEY OF INDIA FOR THE FOREST SURVEY BRANCH.

61. The maps of the Forest Survey Branch continue to be photozincographed at the Trigonometrical Branch Office of the Imperial Survey Department at Dehra Dun, and much in the way of miscellaneous printing, &c., has been done for us by that office; but all work done for the Forest Survey Branch had to be paid for, as was the case the previous year.

Before closing this Report, the Superintendent wishes to acknowledge the assistance he has received from Colonel Wilkins and Mr. Cooke, for the prompt manner in which these officers furnished traverse data for the survey of the forests in the Raipur and Jubbulpore Districts; and Mr. Reynolds also desires to thank Captain Burrard, R.E., for the trouble he has taken during the year with the Forest Survey maps which have passed through the Photozincographic Office at Dehra.

Documents accompanying the Report.

62. The following documents are appended to this Report, *viz.*:—

(1) Index Map to the Forest Survey of Melghat Taluk, Berar, scale 1″=8 miles.

(2) Index Map to the Forest Survey of Bashahr, Punjab, scale 1″=4 miles.

(3) Index Map to the Forest Survey of District Jubbulpore, Central Provinces, scale 8 miles = 1″.

(4) Index Map to the Forest Survey of District Raipur, Central Provinces, scale 8 miles = 1″.

(5) Appendix A.—Summary of outturn of field-work and computations.

(6) Appendix B.—Summary of outturn of drawing and miscellaneous work.

(7) Appendix C.—Summary of Expenditure from 1st October 1887 to 30th September 1888, showing the amounts expended on field and office work (Imperial).

(8) Appendix D.—Summary of expenditure from 1st October 1887 to 30th September 1888, showing the amounts expended on field and office work (Berar).

(9) Appendix E.—Detailed statement showing the expenditure under Survey headings of the Berar Forest Surveys from 1883-84 to 1887-88.

(10) Appendix F.—Area topographically surveyed by the Forest Survey Department during 1887-88.

(11) Annual Form No. 58.—Summary of Revenue and Expenditure (Imperial Surveys) during the Financial year.

(12) Annual Form No. 58.—Summary of Revenue and Expenditure (Berar Surveys) during the Financial year.

(13) Annual Form No. 59.—Account Current.

(14) Annual Form No. 61.—Revenue received and Outstandings on account of Revenue.

DEHRA DUN:
18th December 1888.

W. H. REYNOLDS,
Superintendent of Forest Surveys.